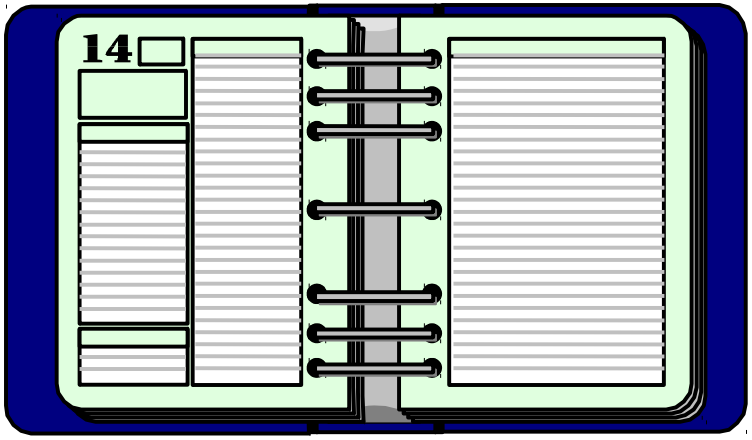
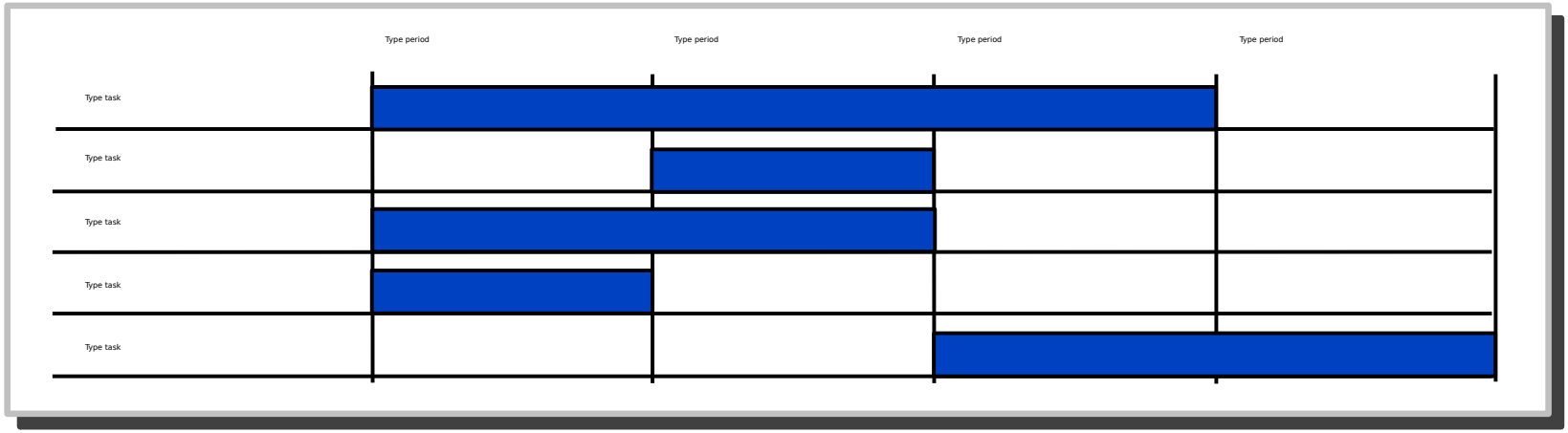
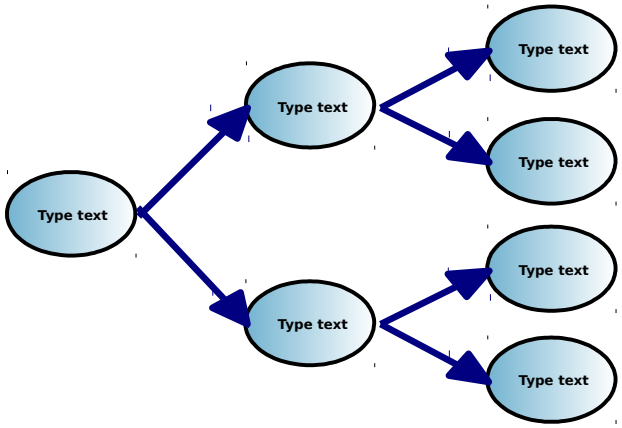
Project Management





OVERVIEW
PROJECT PLANNING and SCHEDULING

The purpose of this lesson is to provide you with the knowledge to plan and supervise drafting and surveying activities for construction projects.



LEARNING OBJECTIVES T.L.O.

Provided a project mission, written project specifications, finished design drawings, a completed bill of materials, a scientific calculator, a computer, software applications, a printer, and the references, implement project planning methods detailing all personnel, equipment, and materials necessary to accomplish the mission while establishing a defined duration for each subtask and the overall project / operation and graphically depict the schedule per the references. (1361-SRVY-2004)

LEARNING OBJECTIVES

E.L.O.

(1). Given written project specifications, and blank writing paper, and references, develop an activities list per the FM 5-412. (1361-SRVY-2004a

(2). Given written project specifications, a completed activity list, and blank writing paper, and references, create a logic diagram per the FM 5-412. (1361-SRVY-2004b)

(3). Given written project specifications, a completed activity list, a completed logic diagram, scientific calculator, and blank activity estimate sheets, and references,

estimate project activity durations per the

LEARNING OBJECTIVES E.L.O.

(4). Given written project specifications, a completed activity list, completed activity estimate sheets, a computer, and automated software application, and references, create a Gantt chart per the FM 5-412. (1361-SRVY-2004d)

(5). Given written project specifications, a completed activity list, completed activity estimate sheets, a computer, and automated software application, and references, complete a logic diagram per the FM 5-412. (1361-SRVY-2004e)

LEARNING OBJECTIVES E.L.O.

(6). Given written project specifications, a completed activity list, a completed logic diagram, completed activity estimate sheets, scientific calculator, and completed activity estimate sheets, and references, create a completed project schedule per the FM 5-412. (1361-SRVY-2004f)

(7). Given a completed project schedule, computer, and automated software application, and references, automate a project schedule per the FM 5-412. (1361-SRVY-2004g)

METHOD AND MEDIA

- LECTURE, DEMONSTRATION, PRACTICAL APPLICATION
- SLIDE PRESENTATION
- DRY-ERASE BOARD
- HANDOUTS

EVALUATION

- CLOSE-BOOK
- WRITTEN / PERFORMANCE
- IRFs

SAFETY / CEASE TRAINING BRIEF

- FIRE
- TORNADO

QUESTIONS

CRITICAL PATH METHOD (CPM)

- **CPM is a form of analysis that is used for planning, scheduling, and controlling construction activities for a project from start to finish.**

- **The CPM requires a formal, detailed listing of all work related activities that make up the project.**

- **Also referred to as:**
  - **Construction Management**
  - **Project Planning and Scheduling**
  - **Critical Path Analysis**

PRELIMINARY PLANNING

- Preliminary planning is a quick overall picture of the project and the capacity of the unit to accomplish it.

- Serves as a guide for detailed planning.

- Includes site recon, preliminary material and equipment estimates, and procurement of critical items.

DETAILED PLANNING

- Develops an accurate estimation of work activities, materials, man-hours, and equipment requirements needed from start to finish.

- Detailed planning includes:
  - Reviewing project specifications and drawings.
  - Detailed estimates of resources.
  - Scheduling work activities.
  - Submitted in the form of a Gantt chart, Pert chart, Activity-on-the-Arrow logic

Job Directive Format

- The job directive is the tasking of a unit to perform construction tasks, and draw needed materials to complete the project assigned.

- Job directives vary in form and content. They are issued in one of two ways:

  - **Verbally** for simple projects.

  - **Written** for more complex projects.

Stages of Detail

- Job directives can be in any one of three stages of detail:

  - **Contain detailed plans and specifications. The more stable the conditions are, the more detailed the job directive becomes.**

  - **May simply refer to standardized drawings, or automated software programs already published.**

  - **May require preparation of complete plans and project specifications to be approved by higher headquarters.**

Job Directive Information

- **Mission:** Exact assignment with all necessary details.
- **Location:** May be given, or left to the unit to select.
- **Time:** Starting time and/or required completion date.
- **Manpower:** Additional manpower that is available.
- **Equipment:** Additional equipment that is

Job Directive Information, cont.

- **Materials:** Source of and authority to request materials.
- **Priorities:** Single priority for the whole project, or separate priorities for various portions of the project.
- **Reports:** Any required reports. (i.e. Weekly status report)
- **Special Instructions:** Any additional information pertaining to the job that is requested.

?

In what two forms may job directives be issued?

In military construction, the planning process is divided into what two stages?

ACTIVITY LISTS (Brainstorming)

An activities (task) list is a complete listing of all required
work activities that must be performed from start to finish.

- An activity list can be brief, or as detailed as need be. The guiding factor to how much detail that is required is dictated by size and complexity of the project.

- An activity list must be developed **mentally** and on **paper** to determine actual activities and their interrelationships to each other.

- The most difficult step is your ability to think **logically**, and make a mental picture of the project in your mind. **Brainstorming** is needed with the assistance of the

ROUGH ACTIVITIES LISTING

PROJECT:
ONE LANE GRAVEL ROAD, 1500 FEET LONG, LEADING TO A CONCRETE STORAGE PAD THAT IS 32’-0” X 32’-0” IN SIZE.

Activities

“Topo” project site grades
Lay gravel alignments
Order gravel forms
Clear roadway
Prefabricate forms drawings
Establish road
Set road
Place concrete
Clear pad site
Create project

Sequencing Activities

- After you have developed your rough activity list in no specific order, you must now put the activities into a "logical" sequence to be performed. The finished activity list is broken down as follows:
  - "**Activity Number**" Column
  - "**Activity**" Column
  - "**Immediately Proceeded By**" (IPB) Column

Types of Activities

- There are five types of activities associated with the development of a finished activities list. Keeping these activities in mind will help you in your logical thinking to develop the activity list on paper.

  - **Starting activities.**
  - **Preceding activities.**
  - **Concurring activities.**
  - **Succeeding activities.**

Sample Finished Activities List

Activity Number	Activity	
IPB		
5	"Topo" project site	
None		
10	Create project drawings	
5		
15	Order gravel	
None		
20	Prefabricate forms	
None		
25	Clear roadway	
10		
30	Set road alignments	
25		
35	Establish road grades	
30		
40	Check road grades	
35		
45	Lay gravel	
15,40		
50	Clear pad site	

DEMONSTRATION

"Going to Morning Formation"

?

What is the process called to develop your activities list?

: What are the five types of activities that are kept in mind when developing a finished activities list?

10 Min

Break!

PLANNING DIAGRAMS

- The most important part of the CPM is the planning diagram. The planning diagram graphically shows the interrelationship between project activities.
  - **It provides a visual blueprint of the work activities that must be performed during construction.**
  - **There are four types of diagrams that can be created. Each serves a specific purpose.**

GANTT CHART

- Also known as a bar chart.

- Gantt charts are "time" oriented.

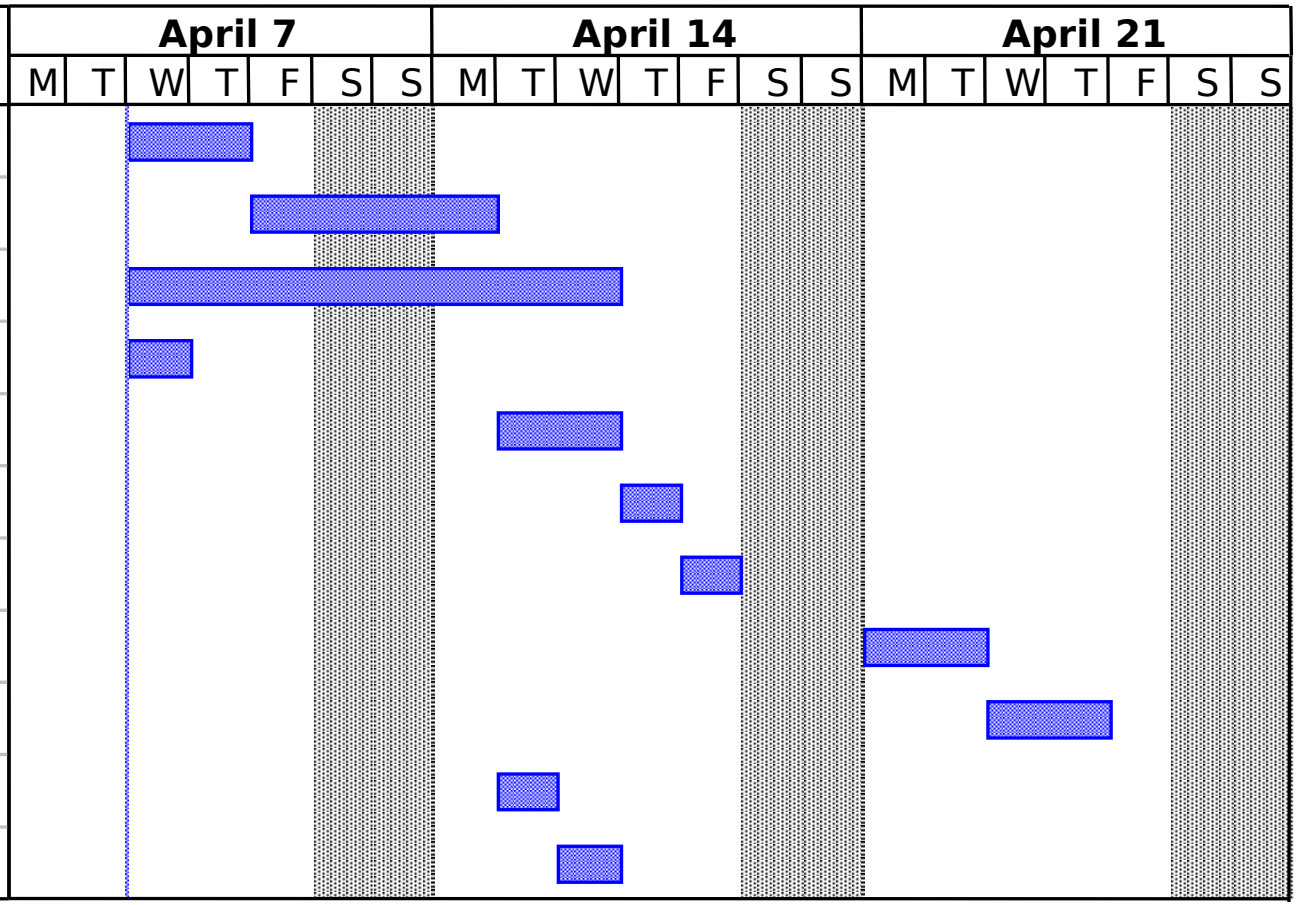
- Activities are graphically shown on a calendar time scale, used primarily for small projects.

- Bars show an activities duration in its entirety, regardless of its dependency on other activities.

- Effortless to construct, and are brief in

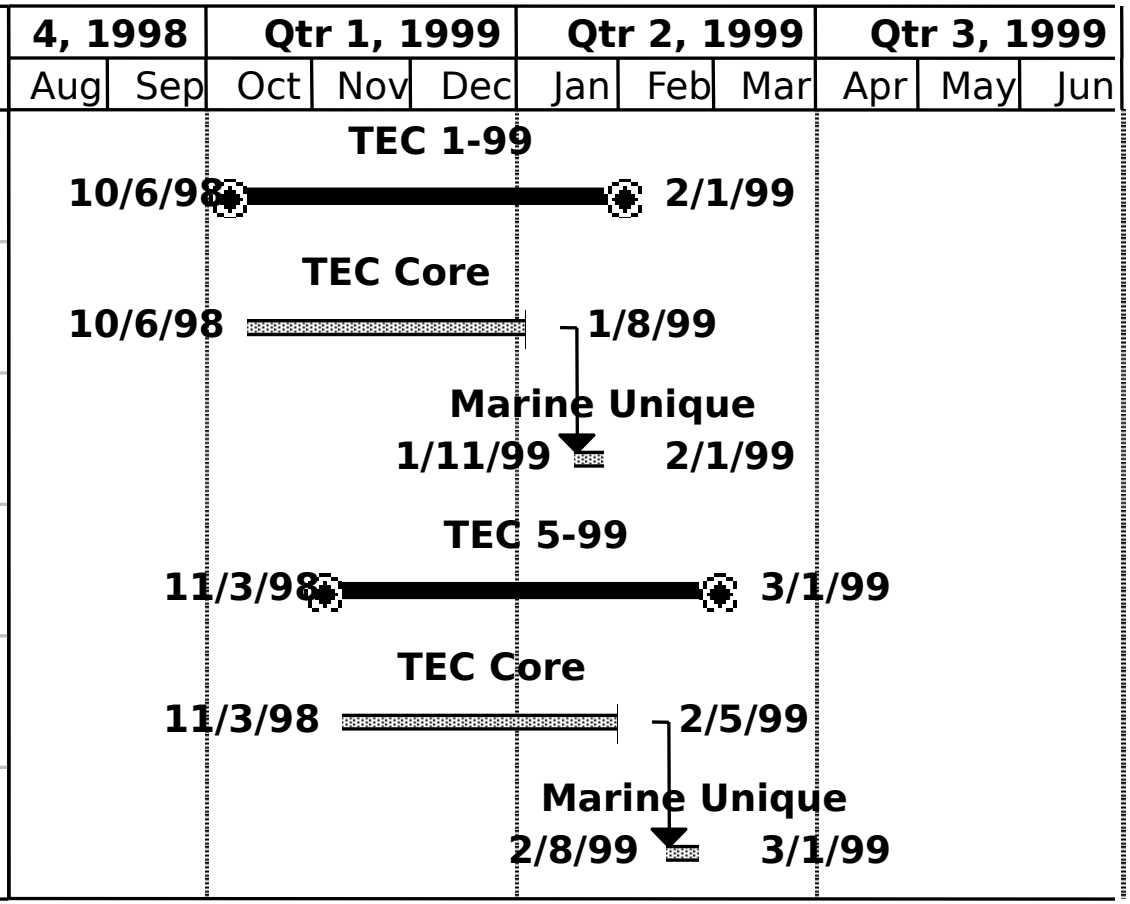
GANTT CHART

ID	Task Name
1	Topo project site
2	Create project drawings
3	Order gravel
4	Prefabricate forms
5	Clear roadway
6	Set road alignments
7	Establish road grades
8	Check road grades
9	Lay gravel
10	Clear pad site
11	Layout pad batterboards



GANTT CHART

ID	Task Name
1	**TEC 1-99**
2	TEC Core
3	Marine Unique
4	**TEC 5-99**
5	TEC Core
6	Marine Unique



GANTT CHART DISADVANTAGES

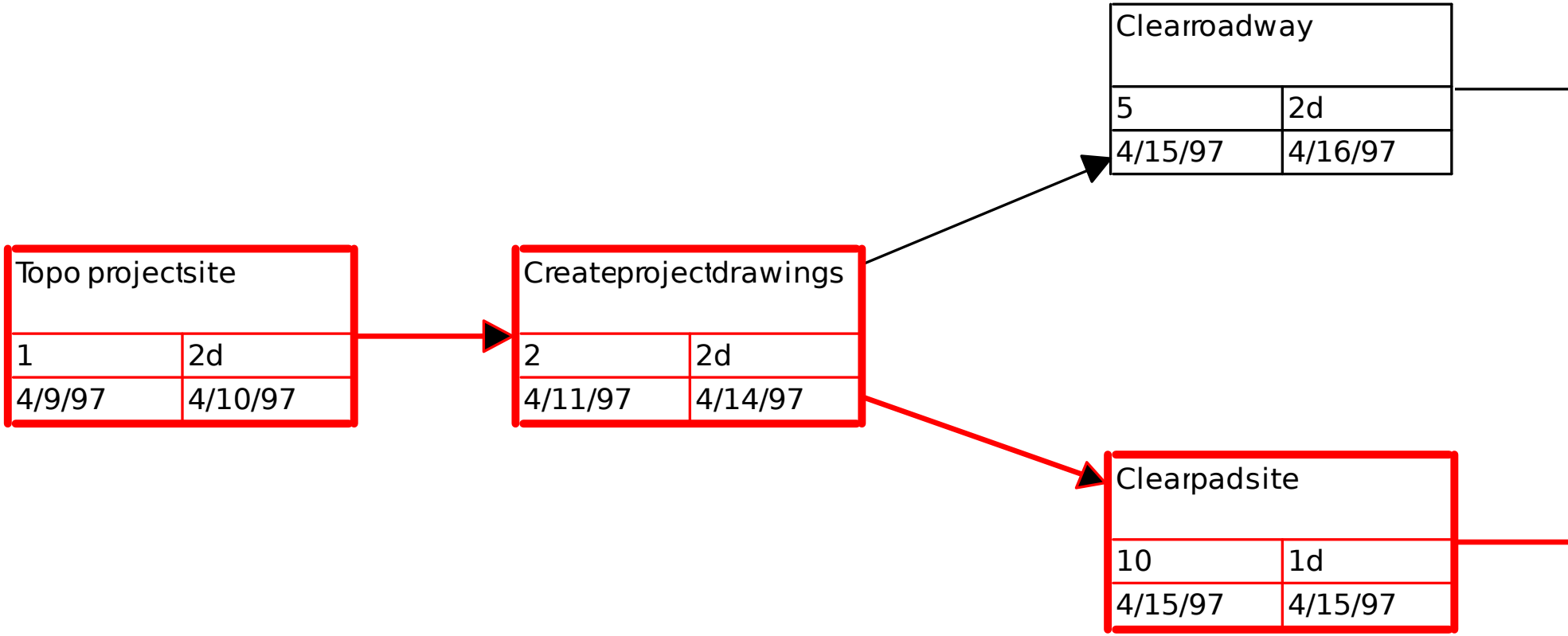
- **Does not give you the ability to visualize the exact progress of the project.**
- **Anticipate delays or problems soon enough to correct them.**
- **Does not show detailed sequence of activities.**
- **Does not show "critical activities".**
- **Does not show precise effect of a delay or failure to complete an activity on time.**

PERT CHART DIAGRAM

- The Program Evaluation and Review Technique (PERT) addresses probability, and is "event" oriented.

- This type of logic diagram is used primarily for research and development projects.

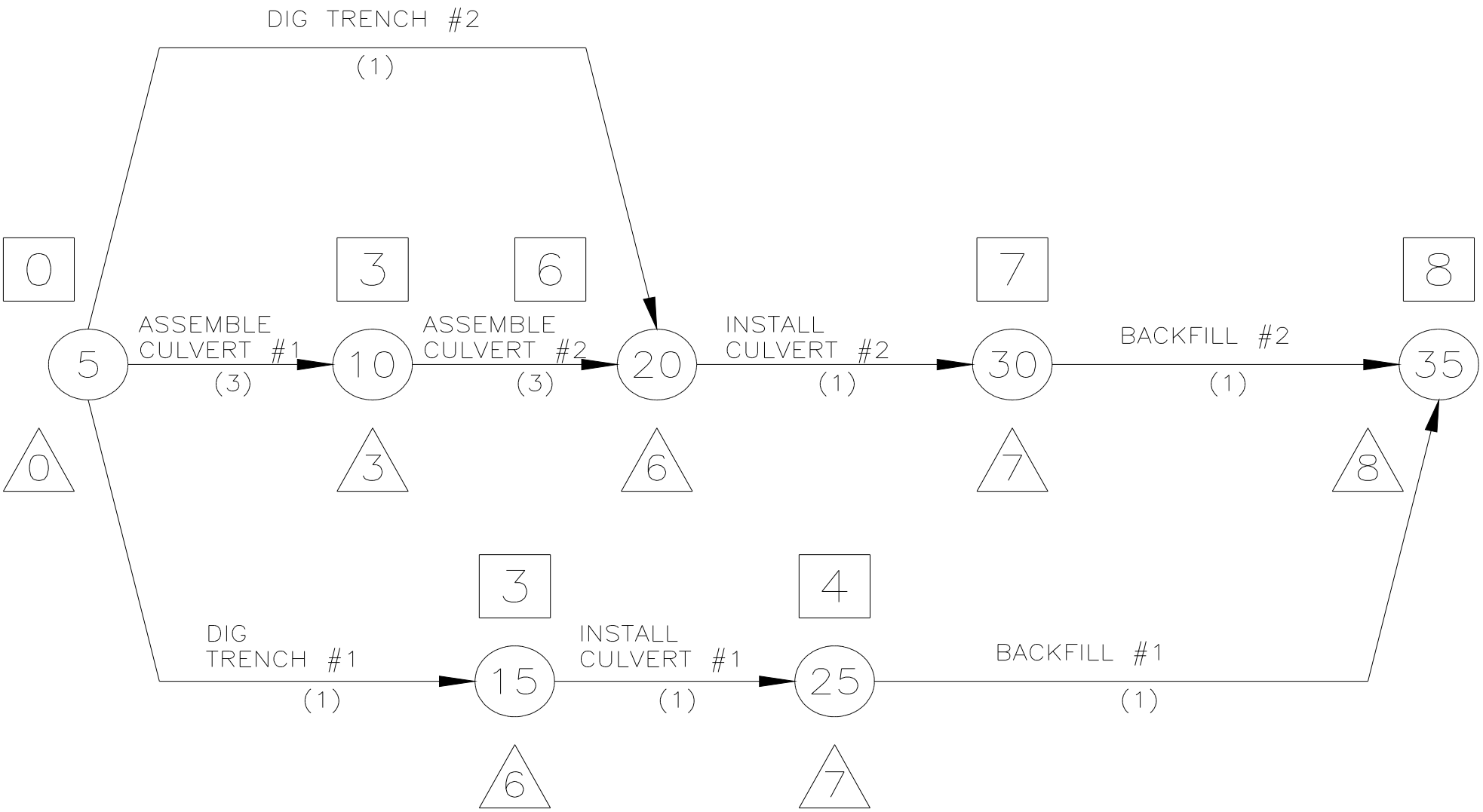
PERT CHART


Clearroadway
5
2d
4/15/97
4/16/97
Topo projectsite
1
2d
4/9/97
4/10/97
Createprojectdrawings
2
2d
4/11/97
4/14/97
Clearpadsite
10
1d
4/15/97
4/15/97

Activity-On-The-Arrow Format

- More complex in its creation.
- Tendency to lead to confusion when trying to interpret it.
- Least desirable format to use because of these factors.

ACTIVITY-ON THE-ARROW CHART



Activity-On-The-Node Format

- Eliminates confusion, and allows you to adjust for problems that may arise during the construction of the project.
- AON format is "activity" oriented.
- This is the primary format used for planning military construction, and especially used for large projects.

Activity-On-The-Node Uses

- Construction planning
- Maintenance planning
- Project Design
- Military combat task planning
- Logistics planning

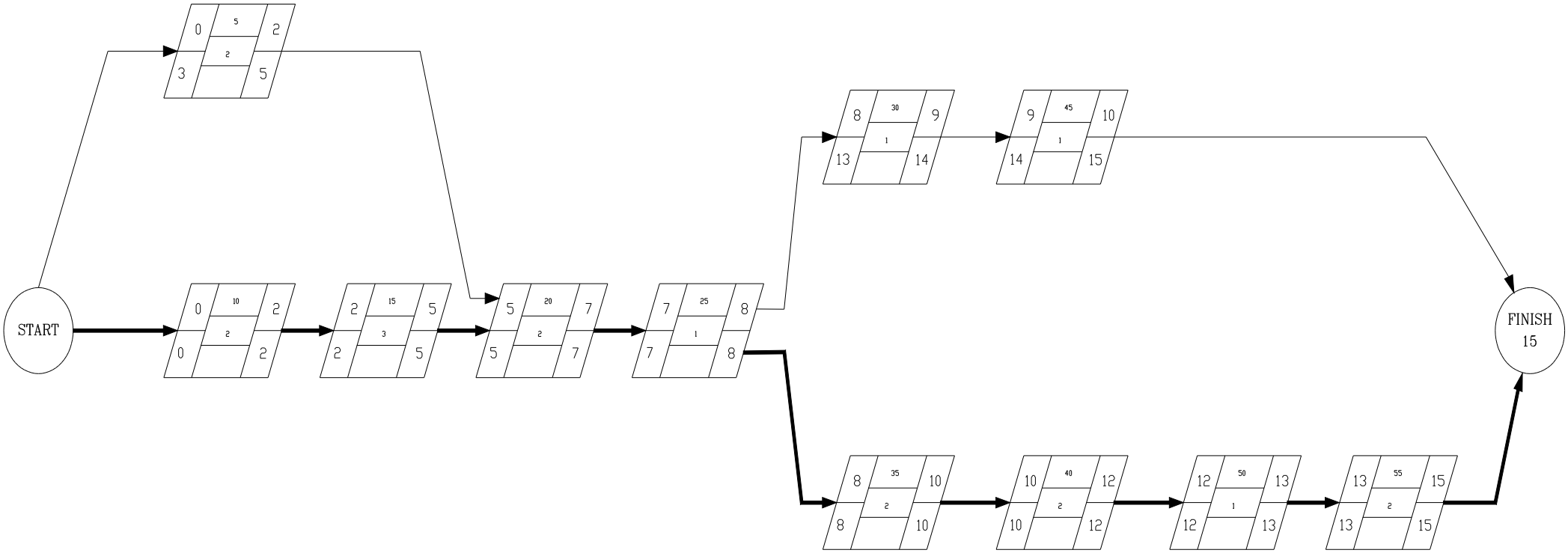
AON Advantages

- **Reduces risk of overlooking essential tasks.**
- **Provides a blueprint for long-range planning.**
- **Shows activity interrelationships.**
- **Focuses attention on critical activities.**
- **Allows you to make timely decisions.**
- **Allows you to manage manpower, material, and equipment resources more effectively.**

AON Disadvantages

- The AON format does not solve engineering problems that may occur.
- Does not make planning decisions for you.
- Does not provide anything substantial to the actual construction of the project itself.

ACTIVITY-ON-THE-NODE



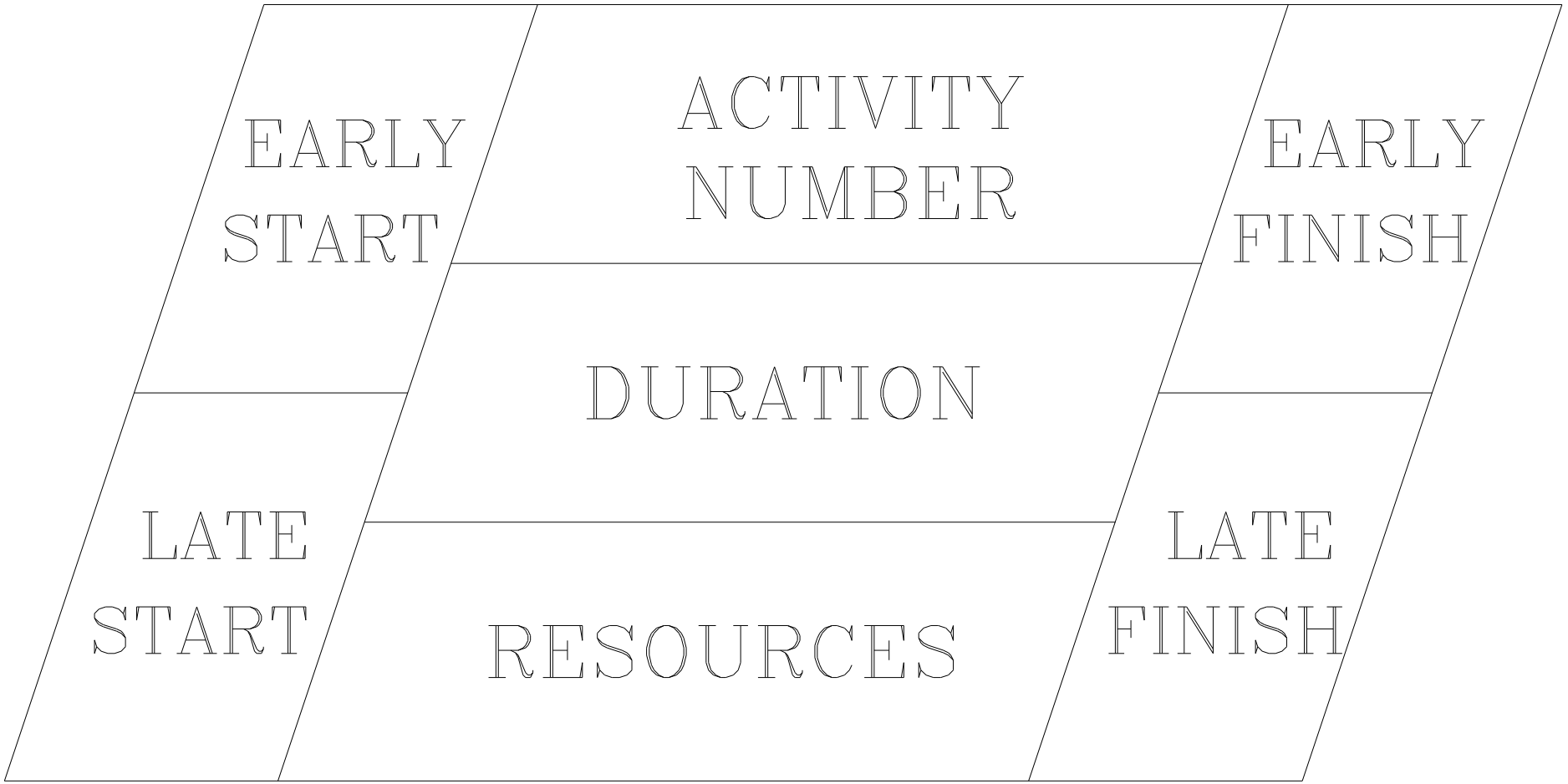
LOGIC DIAGRAM ELEMENTS

After the activity relationships are identified, they are applied to a logic diagram. The standard format for a logic diagram is the "Activity-on-the-Node".

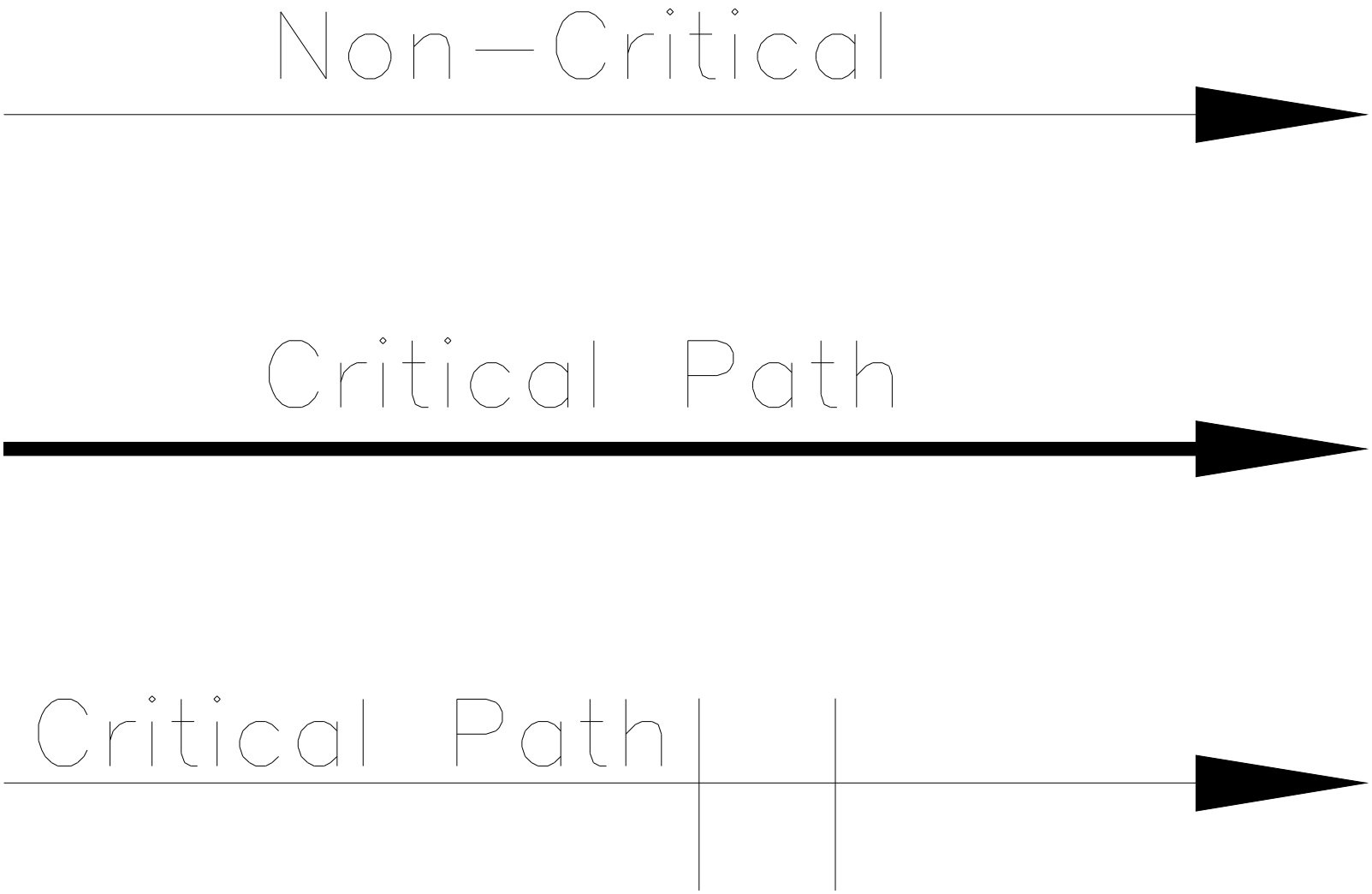
The four basic elements are:

- **Activity Nodes**
- **Start Nodes**
- **Finish Nodes**
- **Precedence Arrows**

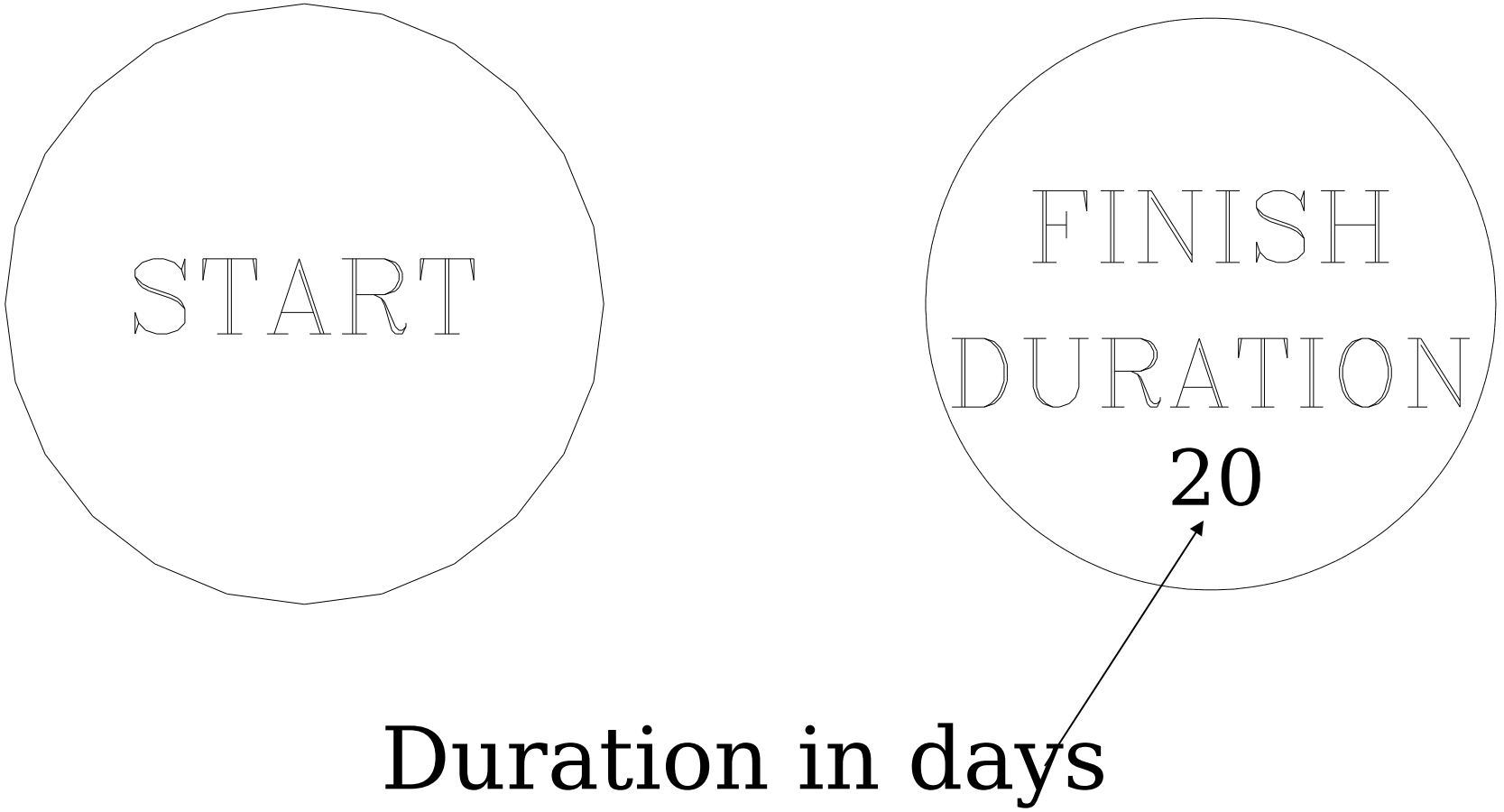
ACTIVITY NODE



PRECEDENCE ARROWS



START AND FINISH NODES



?

What type of planning diagram is “event” oriented?

What type of planning diagram is “time” oriented?

What type of planning diagram is “activity” oriented?

LOGIC DIAGRAMS

- **Shown as a Critical Path Method (CPM) logic diagram.**
- **Shows accurate, timely, and easily understood picture of the whole project.**
- **Easier to plan, schedule, and manage the sequence of required work activities.**
- **Graphically shows the interrelationship of each work activity as they relate to the completion of the whole project.**

CPM DIAGRAM LOGIC RULES

- **Which activities start at the beginning of the project? (Starting)**
- **Which activities must be finished before the start of another? (Preceding)**
- **Which activities can start or finish at the same time as another? (Concurring)**
- **Which activities cannot begin until another is finished? (Succeeding)**

DEMONSTRATION

"Going to Morning Formation"

PRACTICAL EXERCISE

?

What logic rules are used to create a logic diagram?

What must all finishing nodes tie into?

10 Min

Break!

ACTIVITY ESTIMATES

- Estimating each activities required resources and duration times.

- Estimated resources are:
  - Materials
  - Personnel
  - Equipment
  - Man-hours
  - Equipment-hours

MATERIAL ESTIMATES

- Work Items
- Materials
- Quantities
- Waste Factors
- Total Material Requirements
- Bills of Materials

EQUIPMENT/PERSONNEL ESTIMATES

- **Work Items. (Activities)**
- **Material Quantities. (Units of work)**
- **Work Rate. (Man-hour Tables)**
- **Standard Work Effort (Labor). (Quantity x Work Rate)**
- **Efficiency Factor. (Represented as a Percentage)**
- **Troop Effort (Total Labor Hours). (Standard Effort / Efficiency)**
- **Duration (Hours, Days, Weeks, or Months). (Troop Effort / Crew Size)**

DURATIONS

- Durations are calculated based on:
  - **Amount of Material Handled**
  - **Amount of effort put into using manpower**
- Duration Guidelines:
  - **Increasing equipment or Personnel = Reduced duration time of Activity.**
  - **Decreasing equipment or Personnel = Increased duration time of Activity.**
  - **Increasing length of workday = Reduced duration time of Activity.**
  - **Decreasing length of workday = Increased duration time of Activity.**
  - **Working on the weekend = Reduced duration time of the entire project.**

?

What are the two types of estimates?

What effect does increasing equipment quantities have on the duration of an activity?

EARLY/LATE EVENT TIMES

- After all duration's have been computed, you are now able to calculate each activities Early and Late event times. **(Forward Pass and Backward Pass)**
  - Early Start **(ES)**: The earliest time a activity can logically start.
  - Early Finish **(EF)**: The earliest an activity can finish without delaying **follow on** activities. **(ES + Duration)**
  - Late Finish **(LF)**: The latest an activity can finish without delaying the **entire** project.
  - Late Start **(LS)**: The latest time an activity can start without delaying the entire project. **(LF - Duration)**

ACTIVITY LIST WITH ESTIMATED DURATION'S

Activity Number	Activity	IPB	Duration
5	“Topo” project site	None	2 days
10	Create project drawings	5	2 days
15	Order gravel	None	6 days
20	Prefabricate forms	None	1 day
25	Clear roadway	10	2 days
30	Set road alignments	25	1 day
35	Establish road grades	30	1 day
40	Check road grades	35	2 days
45	Lay gravel	15,40	2 days
50	Clear pad site	10	

CRITICAL PATH & CRITICAL ACTIVITIES

- After completing the event times, you can determine the "critical path" of the project and all of the "critical activities" by simple observation using the following guidelines:
  - **The ES for an activity is the same as its LS.**
  - **The EF for an activity is the same as its LF.**

DEMONSTRATION

“EARLY/LATE EVENT TIMES”

PRACTICAL EXERCISE

What are some of the types of resources that must be estimated for an activity?

What is the term that is used to calculate the early event times for a project?

What is the term that is used to calculate the late event times for a project?

10 Min

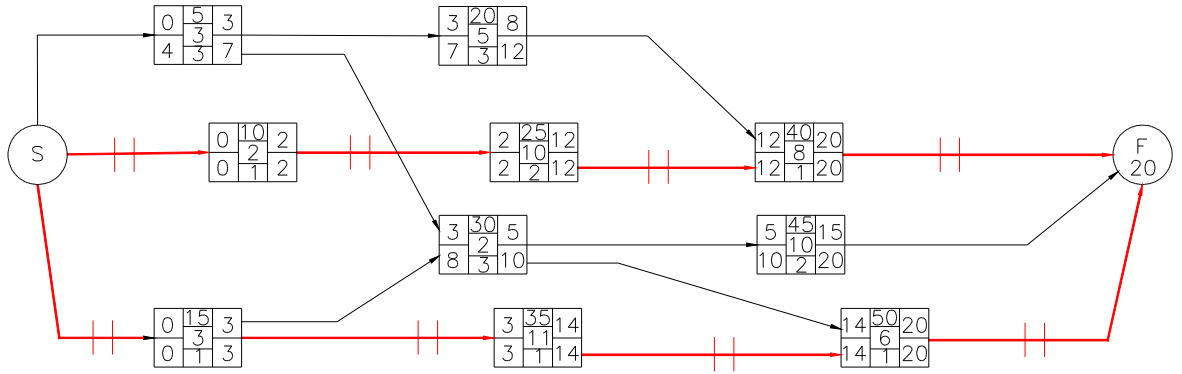
Break!

EARLY START SCHEDULES

- An early start schedule, when joined with the logic diagram, graphically shows all of the planning information that is needed to manage the construction project from start to finish.

- Any activity not on the "Critical Path" will contain some float. Float is any extra time that is available to complete an activity beyond its actual duration, without effecting the entire project.

EARLY START SCHEDULE FORMAT



ACTIVITY NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
5 (20,30)	3 SQ	3 SQ	3 SQ	X	X	X	X																						
10 (25)	1 D	1 D																											
15 (30,35)	1 S	1 S	1 S																										
20 (40)				3 SQ	3 SQ	3 SQ	3 SQ	3 SQ																					
25 (40)			2 SQ	2 SQ	2 SQ	2 SQ	2 SQ	2 SQ	2 SQ	2 SQ	2 SQ	2 SQ																	
30 (45,50)				3 SQ	3 SQ	X	X	X	X	X																			
35 (50)				1 GD	1 GD	1 GD	1 GD	1 GD	1 GD	1 GD	1 GD	1 GD	1 GD	1 GD															
40 (F)													1 GD	1 GD	1 GD	1 GD	1 GD	1 GD	1 GD	1 GD									
45 (F)						2 5T	2 5T	2 5T	2 5T	2 5T	2 5T	2 5T	2 5T	2 5T	2 5T														
50 (F)															1 CP	1 CP	1 CP	1 CP	1 CP	1 CP									
TOTALS																													
DRAFTSMAN	1	1																											
SURVEY CREW	1	1	1																										
GRADER				1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1									
COMPACTOR															1	1	1	1	1	1									
SQUADS	3	3	5	8	8	5	5	5	2	2	2	2																	
5 TON						2	2	2	2	2	2	2	2	2	2														

FLOAT

- Total Float **(TF)**: The entire amount of time that an activity can be delayed without delaying the entire project completion time.

  TF = LS - ES or LF - EF

- Interfering Float **(IF):** Time that is available to delay an activity without delaying the projects entire completion time, but may delay the start of one or more non-critical activities.

  IF = LF -ES of following activity. (Use the smallest ES time)

- Free Float **(FF)**: Time that is available to delay an activity without delaying the start of any other activity, or the entire projects completion time.

  FF = TF - IF

Early Start Schedule Plotting

Start by listing all activity numbers and their succeeding activities.

Draw time brackets: Length is equal to LF-ES. (This will include total float if any)

Note: ES times for starting activities will be day 1. All other ES will begin on the morning of the succeeding day.

Label resource quantities in each appropriate time bracket. Only label the blocks for the activity's normal duration.

RESOURCE ABBREVIATIONS

SQUAD = SQ	7-TON = 7T
SCRAPER = SC	DOZER = DZ
BACKHOE LOADER = BL	EXCAVATOR = EX
COMPACTOR = CP	SHEEPS FOOT = SF
SURVEY CREW = EA	HMMWV = HV
DRAFTSMAN = EA	TRAM = TR
GRADER = GD	DUMP TRUCK= DT

Early Start Schedule Plotting (Cont.)

Interfering Float: When plotting IF work **right to left** starting at the ending bracket, shown as a "X". IF will be plotted first. Any remaining blank/open blocks will be Free Float.

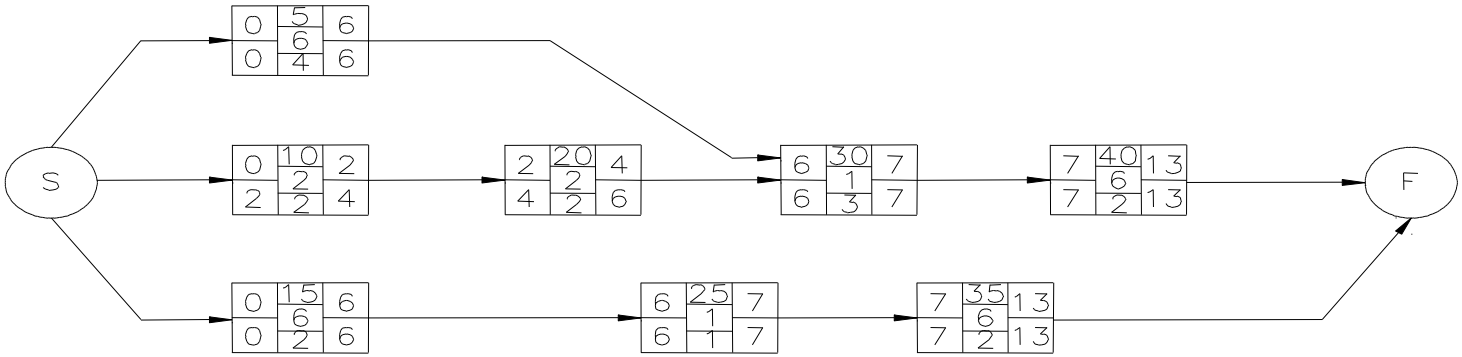
Free Float: FF will fall automatically into position after the IF is marked.

Note: All finishing activities will only have FF and that the critical path will NOT have any float.

The final step is to total all resources for each day and list them at the bottom of the schedule.

DEMONSTRATION

“EARLY START SCHEDULE”



ACTIVITY NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

10 Min

Break!

PRACTICAL EXERCISE

?

What is float?

What is interfering float?

What is free float?

10 Min

Break!

MICROSOFT PROJECT

- Automated Program
  - Planning and Scheduling

- Does not make decisions for you!
  - You provide inputs
    - Activities
      - Resources
      - Duration
    - Project
      - Beginning
      - Finish

MS PROJECT – INITIAL SETTINGS

Date, Time, Duration Settings

- TOOLS Menu
  - OPTIONS Dialogue Box
    - **View** Tab
      - Date Format
    - **Calendar** Tab
      - Day of the week work begins
      - Time of the day work begins and ends
      - Hours work / day and week
    - **Schedule** Tab
      - DAYS – set Activity Duration, time unit format
      - HOURS – set Work Duration
        - NOTE: Slack time = 0; allows MS Proj ect to calculate

MS PROJECT – INITIAL SETTINGS

Date, Time, Duration Settings, cont.

- Tools Menu
  - Change Working Time
    - Set Working Days
    - Set Non-Working Days
      - Weekends automatically considered
      - Holidays

MS PROJECT – RESOURCE SETTINGS

T/O (Manpower)

T/E (Equipment)

- VIEW Menu
  - RESOURCE SHEET
    - Resource Name
    - Resource Initials
    - Maximum Units
      - Unit, Company, Platoon, Section
  - GANTT CHART

MS PROJECT – ACTIVITY INFORMATION

PROJECT ACTIVITY INFORMATION INPUT

- VERTICAL DISPLAY DIVIDER
  - Pick, Drag all the way to the right to view entire Activity sheet
- Type Name of first Activity
  - Left Arrow Key
    - Column
      - **Duration**
    - Column
      - **Starting Date**
    - Column (Left Arrow Key **x2**)
      - **Predecessors**

MS PROJECT – ACTIVITY INFORMATION, cont.

PROJECT ACTIVITY INFORMATION INPUT

- Resource information – leave blank
- Repeat previous procedures for the remaining Activities in your list.
  - Skip “STARTING DATES”, they will be automatically calculated due to IPB

- INSERT Menu
  - **Resource Assignment** Dialogue box
    - Type of Resource
      - Quantity
        - Units
  - Repeat for all Activities
    - Close

MS PROJECT – EDITING PLANNING DIAGRAMS

Activity Information Inputs = Automatic Planning

Diagram Creation

- **GANTT Chart**
  - Pick, Drag Vertical Divider all the way to the left so the entire GANTT Chart can be viewed
  - Pick **FORMAT** Menu
    - Select BAR STYLES Option
      - **NAME** Column
        - Pick PROGRESS
          - Pick CUT ROW (eliminates clutter for printout)
          - Do not <u>delete</u> TASK
  - INFORMATION Display Format
    - Pick TASK Name
      - Pick TEXT Tab

MS PROJECT – EDITING PLANNING DIAGRAMS, cont.

- **PERT Chart**
  - Chart created is not in logical sequence
  - Drag and Drop Activity Node so the Precedence Arrow Logically connect each node
    - Begin Arranging
      - Starting Activities first then remaining Activities to the last
      - Note: PERT Chart does not have a Start or Finish Node

MS PROJECT – PROJECT REPORTS

- Supplements Planning Diagrams with:
  - Pick VIEW in the Menu Bar
    - **RESOURCE USAGE**
    - **RESOURCE GRAPHS**
      - REPORTS
        - OVERVIEW
          - Top-Level Tasks
          - Critical Tasks
          - Working Days
      - CURRENT ACTIVITIES
        - Unstarted Tasks
      - ASSIGNMENTS
        - Who does what
        - Who does when

DEMONSTRATION

PRACTICAL EXERCISE

?

How does Microsoft Office Project calculate float times?

Does a PERT Chart have a Start and Finish Node?

SUMMARY

- Critical Path Method in project planning and scheduling

- Activities List
  - Brainstorming
  - Sequencing

- CPM Logic Diagram

- Activity Resources

- Early Start Schedule

- MS Project Production